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TENNESSEE STATE DEPT OF CONSERVATION NASHVILLE DIV 0--ETC F/G 13/13
NATIONAL PROGRAM OF INSPECTION OF NON-FEDERAL DAMS, TENNESSEE. --ETC(U)
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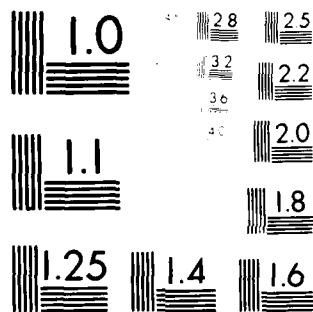
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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) Kagley Dam intercepts an unnamed tributary of Sixmile Creek about one mile south of the Mint Community in Blount County. The crest of the 27.6 foot high earth- filled embankment is 12 feet wide and 168 feet long. Means of discharge from the reservoir include a riser with a 6 inch outlet and a parabolic open channel spillway in the right abutment. The embankment slopes, greather than 1V:3H, do not appear to be steep and there is no evidence of slides or other signs of instability. A soft area on the downstream face near the middle of the embank- ment does not appear to threaten the safety of the dam. A break in the service		

spillway outlet pipe near the toe allowed erosion of the embankment to form a 4 foot diameter hole over the break. Although this break does not jeopardize the integrity of the embankment, the possibility of other breaks due to embankment settlement poses a threat to the safety of the dam. Kagley Dam is classified in the small size and high hazard potential categories and therefore is required to pass a design storm of between the half and full probable maximum flood (PMF). Hydraulic analysis reveals the spillway to be seriously inadequate due to the inability to pass the 100 year storm which overtops the dam by a maximum depth of 0.18 feet for a duration of 2.57 hours. The dam is overtopped by the 1/2 PMF by a maximum depth of 1.8 feet for a duration of 5.66 hours. (At this time) the condition classification of the dam is considered to be "unsafe-nonemergency". It is recommended that qualified engineers be engaged immediately to: 1) determine project modifications to safely pass the design storm; 2) investigate with recommendations the safety of the service spillway outlet pipe; and 3) develop an appropriate warning system.



DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT, CORPS OF ENGINEERS
P. O. BOX 1070
NASHVILLE, TENNESSEE 37202

25 SEP 1981

IN REPLY REFER TO

ORND-G

Honorable Lamar Alexander
Governor of Tennessee
Nashville, TN 37219

Dear Governor Alexander:

Furnished herewith is the Phase I Investigation Report on Kagley Dam near Wellsville, Tennessee. The report was prepared under the authority and provisions of PL 92-367, the National Dam Inspection Act, dated 8 August 1972.

The report presents details of the field inspection, background information, technical analyses, findings, and recommendations for improving the condition of the dam.

Based upon the inspection and subsequent evaluation, Kagley Dam is classified as unsafe-nonemergency due to insufficient storage and spillway capacity to pass the one-half probable maximum flood and the existence of a possibly defective spillway outlet pipe.

We do not consider this an emergency situation at this time, but the recommendation concerning project modifications to allow safe passage of the design flood and others contained in this report should be undertaken in the near future to minimize the risks to the residence and county road located downstream.

Public release of the report and initiation of public statements fall within your prerogative. However, under provisions of the Freedom of Information Act, the Corps of Engineers is required to respond fully to inquiries on information contained in the report and to make it accessible for review on request.

Your assistance in keeping me informed of any further developments will be appreciated.

Sincerely,

LEE W. TUCKER
Colonel, Corps of Engineers
Commander

1 Incl
As stated

CF:
Mr. Robert A. Hunt, Director
Division of Water Resources
4721 Trousdale Drive
Nashville, TN 37220

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PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM


Name of Dam Kagley
County Blount
Stream Unnamed Trib. of
Sixmile Creek
Date of Inspection May 19, 1981

This investigation and evaluation was prepared by the
Tennessee Department of Conservation, Division of
Water Resources.

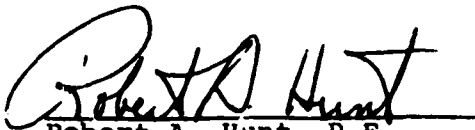
Prepared By:


Troy A. Wedekind
Regional Engineer

Approved By:


Edmond B. O'Neill
Chief Engineer
Safe Dams Section

Approved By:


Robert A. Hunt, P.E.
Director, Division of
Water Resources
Tennessee Department
of Conservation



Kagley Dam, Blount County, Tennessee 6/26/81

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
TENNESSEE

Name of Dam Kagley
County Blount
Stream Unnamed Trib. of
Sixmile Creek
Date of Inspection May 19, 1981

ABSTRACT

Kagley Dam intercepts an unnamed tributary of Sixmile Creek about one mile south of the Mint Community in Blount County. The crest of the 27.6 foot high earth-filled embankment is 12 feet wide and 168 feet long. Means of discharge from the reservoir include a riser with a 6 inch outlet and a parabolic open channel spillway in the right abutment.

The embankment slopes, greater than 1V:3H, do not appear to be steep, and there is no evidence of slides or other signs of instability. A soft area on the downstream face near the middle of the embankment does not appear to threaten the safety of the dam. A break in the service spillway outlet pipe near the toe allowed erosion of the embankment to form a 4 foot diameter hole over the break. Although this break does not jeopardize the integrity of the embankment, the possibility of other breaks due to embankment settlement poses a threat to the safety of the dam.

Kagley Dam is classified in the small size and high hazard potential categories and therefore is required to pass a design storm of between the half and full probable maximum flood (PMF). Hydraulic analysis reveals the spillway to be seriously inadequate due to the inability to pass the 100 year storm which overtops the dam by a maximum depth of 0.18 feet for a duration of 2.57 hours. The dam is overtopped by the $\frac{1}{2}$ PMF by a maximum depth of 1.8 feet for a duration of 5.66 hours.

At this time, the condition classification of the dam is considered to be "unsafe-nonemergency". It is recommended that qualified engineers be engaged immediately to:

- 1) determine project modifications to safely pass the design storm;
- 2) investigate with recommendations the safety of the service spillway outlet pipe; and
- 3) develop an appropriate warning system.

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PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
KAGLEY DAM
BLOUNT COUNTY, TENNESSEE

SECTION 1 - GENERAL

- 1.1 Authority - The Phase I inspection of this dam was carried out under the authority of Tennessee Code Annotated, Sections 70-2501 to 70-2530, The Safe Dams Act of 1973, and in cooperation with the U. S. Army Corps of Engineers under the authority of Public Law 92-367, The National Dam Inspection Act.
- 1.2 Purpose and Scope - The purpose of a Phase I investigation is to develop an engineering assessment of the general condition of a dam with respect to safety and stability. This is accomplished by conducting a visual inspection, reviewing any available design and construction data, and performing appropriate hydraulic, hydrologic, and other analyses. A comprehensive description of the Phase I investigation program is given in Recommended Guidelines for Safety Inspection of Dams, Department of the Army, Chief of Engineers, Washington, D. C. 20314.
- 1.3 Past Inspections - A survey was made for the purpose of inventory on October 8, 1979, by the Tennessee Department of Conservation, Division of Water Resources and the U. S. Army Corps of Engineers. At that time, a depression area was found near the toe of the dam along the centerline of the outlet pipe. The crack in the 2 inch valve was noted.
- 1.4 Details of Inspection - The Phase I inspection was conducted on May 19, 1981. The weather at the time of the inspection was partly cloudy with an easterly wind up to 10 miles per hour. The temperatures were near 80° F and a light shower ensued after the inspection. The reservoir level was below normal pool and appeared to be maintained in that condition.
- 1.5 Inspection Team Members - The field inspection was performed by the following State personnel:
- Ed O'Neill, Chief Engineer
Troy Wedekind, Regional Engineer
George Moore, Regional Engineer

SECTION 2 - PROJECT DESCRIPTION

- 2.1 . Location - The dam is on an unnamed tributary of Sixmile Creek in Blount County, Tennessee, about a mile south of the community of Mint. The dam was constructed since the last revision to the Binfield, Tennessee, 7.5 minute U. S. Geological Survey (USGS) quadrangle map. The site is 35°37'34" north latitude and 84°02'08" west longitude (Figures 1 and 2).
- 2.2 History of Project - The dam was built in 1964 by the current owner, J. S. Kagley, but no data on the designer or contractor is available. The lake is used for irrigation and recreation purposes.
- 2.3 Size and Hazard Classification - With a structural height of 27.6 feet and a maximum impounding capacity of 57.8 acre-feet, the dam is considered to be of the small size category. The project is considered to be in the high hazard potential category because of one dwelling with at least 4 occupants located about 600 feet downstream of the embankment. A county road (Mint Road) with a bridge located about 1,000 feet downstream would also be severely damaged in the event of a sudden failure.
- 2.4 Description of Dam and Appurtenances
- 2.4.1 Embankment - The embankment is apparently a homogeneous earthfill of the sandy clay derived from the in-situ weathering of the underlying quartzose calcarenite bedrock of the Chota Formation. The Soil Conservation Service describes the soil as Christian loam that is predominantly MH or CL of the Unified Soil Classification. The soil is grouped with the Sequoia and Tellico series with closer characteristics with the latter. The dam has a maximum structural height of 27.6 feet. The crest has a linear horizontal alignment with a gradual transition with each abutment (photo no. 4). The crest is 12 feet wide, 168 feet long, and is covered by a gravel and asphalt road that services a single dwelling. The elevations across the crest vary from 957.4' msl to 955.3' msl with a drastic decrease in elevation towards the right

end of the dam at the emergency spillway interface (photo no. 9; Figure 4). The upstream face is generally sloped at 3.4H:1V from the crest to the water surface where a small bench has formed from slight wave erosion. The downstream face is generally sloped at 3.5H:1V uniformly across the embankment. All slopes are covered with well maintained grass.

- 2.4.2 Service Spillway - The service spillway consists of a riser of unknown diameter that is covered with a well pressure tank that serves as a trash rack. The outlet to the riser is a 6 inch steel pipe.
- 2.4.3 Emergency Spillway - The emergency spillway consists of an open channel on the right abutment. The control section has an asphalted parabolic shape. The entrance and exit channels are moderately sloped with a grass cover and have approximate lengths of 50 feet and 150 feet respectively.
- 2.4.4 Drawdown Facility - No drawdown drain is provided with the service spillway riser but a 2 inch steel water supply pipe near the service spillway outlet could provide drawdown capability to an unknown depth.
- 2.5 Downstream Channel - The natural channel is well defined and roughly 4 feet wide and 2 feet deep. The channel cut through the top soil and has a bed of small size colluvium.
- 2.6 Reservoir and Drainage Area - At normal pool, the reservoir has a surface area of 4.6 acres and an impounding capacity of 45.5 acre-feet. From normal pool, the flood storage capacity to the top of the dam is 12.3 acre-feet. The drainage area has 93.6 acres with moderately steep slopes. Most of the drainage area is wooded with pasture on some of the ridgetops.

SECTION 3 - INSPECTION FINDINGS

3.1 Visual Inspection

- 3.1.1 Embankment - The upstream slope above the water surface was found to have a good cover of well maintained grass on a fairly uniform, continuous grade of 1V:3.4H (photo 2). The grass cover serves as slope protection from surface runoff with no erosion of the grassed face detected. However, there is no slope protection at the water line and minor sloughing from erosion is occurring along the entire water line resulting in a slight benching below the water surface. No signs of structural instability were found.

A gravel and asphalt road covers the entire crest with a width of 12 feet (photo 2). The road is in good condition and serves as access for a single dwelling. The crest is linearly aligned and is roughly 170 feet long. Along the crest and towards the right end of the dam, there is a decline in elevation with a noticeable drop, roughly 1 foot, in the area of the right abutment where the emergency spillway is located (photo 9).

The downstream face has a gradual transition with each abutment giving the appearance of a "bowl" shape. The downstream slope was found to have a good cover of well maintained grass on a fairly uniform continuous grade of 1V:3.5H (photo 3). There are three 4 inch diameter pine trees evenly spaced on the slope a few feet below the crest (photo 4). Near the middle of the dam and approximately halfway down the slope a soft area, roughly 5' X 20', was observed with wetland vegetation (photos 10 & 11). A rut roughly 10 feet long and 3 inches deep was located down from the soft area near the toe (photos 10 & 11). There was no evidence of seepage from either area.

A hole was located near the toe along the centerline of the spillway outlet pipe (photos 3, 5, 10, 13, and 14). The hole was roughly 4 feet in diameter and about 3 feet deep. Both the 2 inch water supply pipe and the 6 inch service spillway outlet pipe could be

seen in the hole (photo 14). The service spillway pipe was broken and had a downward vertical displacement at an apparent weld seam. A very small amount of seepage was detected in the hole to the right of the service spillway outlet pipe. A few small diameter logs were exposed in the hole (photo 13).

No cracks, slides, or other evidence of slope instability was found on the slope.

- 3.1.2 Concrete or Masonry Sections - No concrete or masonry sections were found on the structure.
- 3.1.3 Service Spillway - The service spillway consists of a 6 inch steel barrel connected to a riser of an unknown diameter. A portion of a well pressure tank, used for a trash rack, covered the riser inlet (photo 1). Sediment has half filled the outlet with weeds and briars heavily covering the area (photos 5, 6, and 7). The portion of the pipe exposed in the hole described in the previous section showed signs of minor rusting. As mentioned in Section 3.1.1, the outlet pipe was broken in the hole roughly 15 feet upstream from the discharge outlet and was displaced about 3 inches below the original alignment (photo 13).
- 3.1.4 Emergency Spillway - The emergency spillway is a graded earth channel with a parabolic shape located in the right abutment. The entrance and exit channels are well grassed with the control section being the asphalted road (photo 9). The spillway crest is only 0.2 feet below the low point in the embankment crest (Figure 6). Much of the spillway depths appears depleted by the vertical curve of the road.
- 3.1.5 Drawdown Facilities - No apparent drawdown drain is incorporated with the riser facility but a 2 inch pipe, apparently used for water supply, was found near the service spillway outlet. The pipe was valved downstream and was leaking through a crack in the valve (photos 6 & 8). The inlet for the pipe is remote from the riser at an unknown depth in the lake.

- 3.1.6 Downstream Channel - The shallow stream channel passes along the base of a small hill that constitutes the right abutment. The floodplain is narrow and is used for pasture (overview photo).
- 3.1.7 Reservoir and Drainage Area - The reservoir is approximately 4.6 acres at normal pool. The reservoir appears relatively clear with no significant amount of siltation. The drainage area is approximately 93.6 acres that is mainly woodland with some pasture (Figure 2).
- 3.2 Review of Data - No design or construction data were available.
- 3.3 Static and Seismic Stability Assessment - The actual margin of safety for static stability cannot be determined since the engineering data required for an analytical stability analysis is not available without extensive embankment and foundation exploration. Consequently, the assessment of the embankment stability must be based on visual evidence and engineering judgment. On this basis, the stability of the dam appears adequate.

The dam is in seismic zone 2. No seismic stability analysis is required for the Phase I investigation provided static stability conditions are satisfied and conventional safety margins exist.

- 3.4 Hydraulic and Hydrologic Analysis - According to OCE guidelines, the design flood for a dam in the small size and high hazard categories is between the half and full PMF. Hydraulic analysis indicates that under antecedent moisture condition II (AMC II) outflow resulting from the 100 year storm (P_{100}) overtops the dam by a maximum depth of 0.18 feet and for a total overtop duration of 2.57 hours. The outflow resulting from the $\frac{1}{2}$ PMF will overtop the dam by a maximum depth of 1.8 feet and for a total duration of 5.66 hours. All overtop conditions consider no breach of the dam.
- 3.5 Geologic Setting - Geologic mapping of the area by the USGS indicates that the dam is located on the

Chota Formation which is mostly calcarenite containing varying quantities of quartz grains. The soil from this parent rock, to which the embankment was constructed, is generally sandy clay that can generally be classified as MH or CL.

3.6 Conclusions and Recommendations

- 3.6.1 Conclusions - There is no evidence of sliding or undue settlement and the embankment slopes do not appear excessively steep. The soft area near the center of the embankment does not appear to threaten the safety of the embankment, therefore, the stability of the dam appears adequate.

The dam is in seismic zone 2, indicating that risk of damage due to seismic activity is moderate.

Hydraulic analysis indicates that the project's spillway is grossly inadequate to pass the design flood. Outflow resulting from the P₁₀₀ will overtop the dam by a maximum depth of 0.18 feet and for a total duration of 2.57 hours. In the event of one half the PMF, the maximum depth of overtop will be 1.8 feet and for a total duration of 5.66 hours. This overtopping would probably result in a failure of the dam. Since the project fails to safely pass the $\frac{1}{2}$ PMF, its spillway capacity is considered to be seriously inadequate.

The hole on the downstream face appears to be caused by the erosion from service spillway flow of the embankment material around the break in the service spillway outlet pipe. Although the break in the spillway outlet pipe does not pose a threat to the integrity of the dam, the possibility of other breaks in the middle section of the embankment due to settlement pressures poses a threat to the safety of the dam.

The dam is considered "unsafe-nonemergency" because of its seriously inadequate spillway and the possibility of a defective spillway outlet pipe.

- 3.6.2 Recommendations - The owner should maintain the reservoir well below the riser intake and a qualified engineer should be engaged immediately to:

- a. Recommend project modifications that will allow the spillway to safely pass the design flood;

- b. Investigate and make recommendations on the safety of the service spillway outlet pipe and on any leakage in the area of the outlet pipe;
- c. Investigate the 2 inch pipe and make recommendations including the placement of the valve upstream; and
- d. Develop an appropriate warning system to alert downstream residents of dangerous conditions.

In addition, the owner should:

- a. Remove all trees from the embankment;
- b. Establish a regular program of inspection and maintenance; and
- c. Monitor the soft area near the center of the dam for any physical change or sign of seepage. If either is detected, consult a qualified engineer.

SECTION 4 REVIEW BOARD FINDINGS

The Interagency Review Board for the National Program of Inspection of Non-Federal Dams met in Nashville on 3 September 1981 to examine the technical data contained in the Phase I investigation report for Kagley Dam. The Review Board considered the information and recommended that (1) the owner should periodically check the soft area on the embankment and consult a qualified engineer should any changes occur, and (2) a qualified engineer should investigate and make recommendations concerning the broken 2-inch pipe. The valve on this pipe should be moved to the upstream side of the dam. They agreed with other report conclusions and recommendations. A copy of the letter report presented by the Review Board is included in Appendix F.

APPENDIX A
DATA SUMMARY

APPENDIX A
DATA SUMMARY

A.1 Dam

A.1.1 Type - Earthfill

A.1.2 Dimensions and Elevations

- a. Crest length - 168'
- b. Crest width - 12'
- c. Height - 27.6'
- d. Crest elevation (low point) - 955.3'
- e. U/S slope above water line - 1V:3.4H
- f. D/S slope - 1V:3.5H
- g. Size classification - Small

A.1.3 Zones, Cutoffs, Grout Curtains - None

A.1.4 Instrumentation - None

A.2 Reservoir and Drainage Area

A.2.1 Reservoir

a. Normal Pool

- 1) Elevation - 952.4'
- 2) Surface area - 4.6 acres
- 3) Capacity - 45.5 acre-feet
- 4) Length - 1400'

b. Maximum Pool (top of dam)

- 1) Elevation - 955.3'
- 2) Surface area - 4.8 acres
- 3) Capacity - 57.8 acre-feet

A.2.2 Drainage Area

- a. Size - 93.6 acres
- b. Average slope - 23.8%
- c. Soils - Christian, Tellico, Barborville,
Dandridge
- d. Land use - Forest, pasture
- e. Runoff (AMC II)
 - 1) PMF - 24.66"
 - 2) $\frac{1}{2}$ PMF - 12.33"
 - 3) 100 yr flood - 2.20"

A.3 Outlet Structures

A.3.1 Service Spillway

- a. Type - Stand pipe
- b. Diameter - Unknown
- c. Elevation - 952.4'
- d. Outlet - 6" cast iron pipe
- e. Maximum discharge capacity - 2.01 cfs

A.3.2 Emergency Spillway

- a. Type - Parabolic channel
- b. Width - 35'
- c. Crest elevation - 955.1'
- d. Maximum discharge capacity - 6.28 cfs

A.3.3 Drawdown Facilities

- a. Type - 2" steel pipe used for irrigation
- b. Control - Valve at the downstream outlet of the pipe

A.4 Historical Data

A.4.1 Construction Date - 1964

A.4.2 Designer - None

A.4.3 Builder - J. S. Kagley

A.4.4 Owner - J. S. Kagley

A.4.5 Previous Inspections - Pre-inspection survey by TDWR 10/8/79

A.4.6 Seismic Zone - 2

. A.5 Downstream Hazard Data

A.5.1 Downstream Hazard Potential Classification

- a. Corps of Engineers - High
- b. State of Tennessee - 1

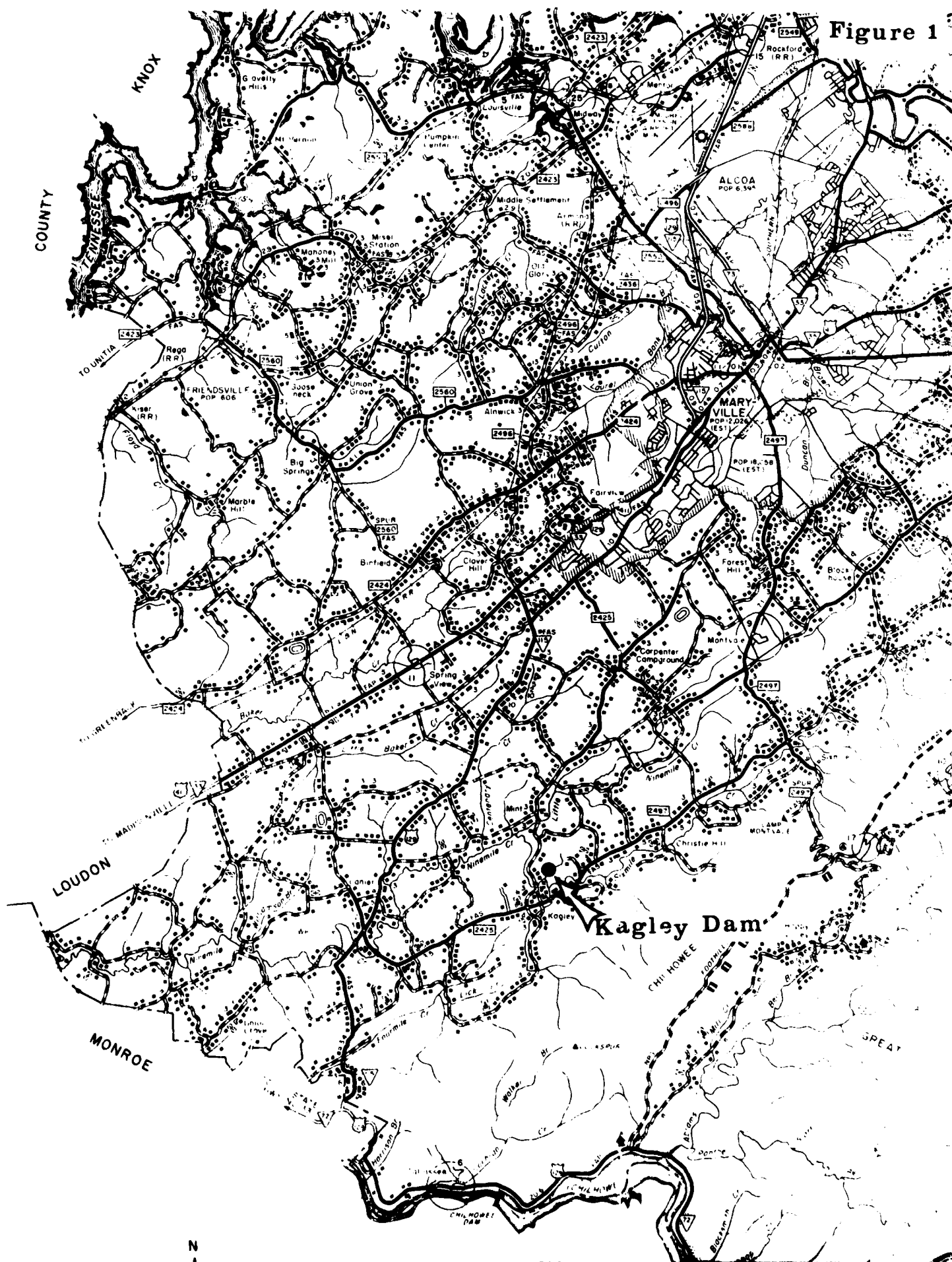
A.5.2 Persons in Probable Flood Path - 4

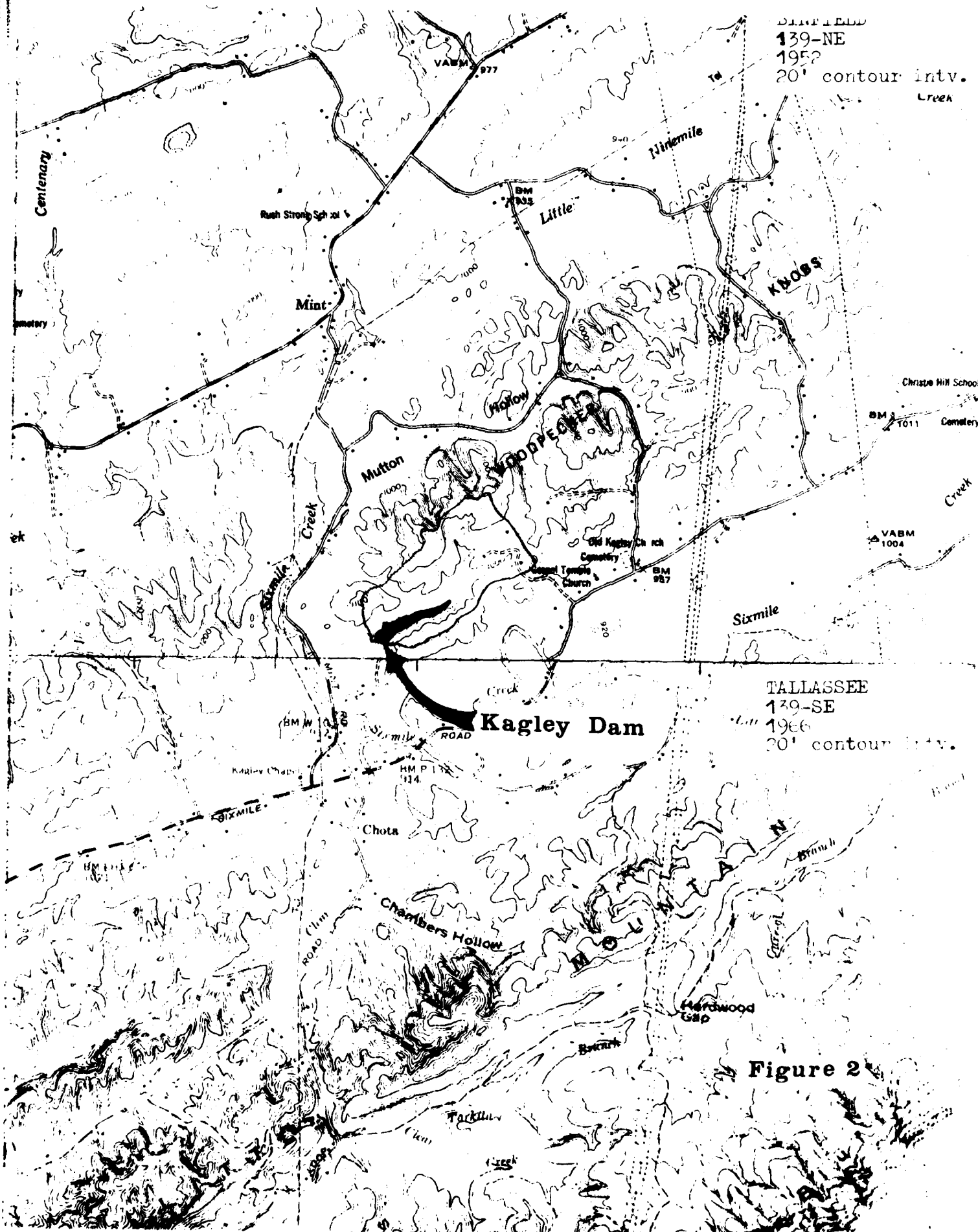
A.5.3 Downstream Property - 1 family dwelling 500' downstream and a county road 700' downstream

A.5.4 Warning Systems - None

APPENDIX B
SKETCHES AND LOCATION MAPS

Figure 1





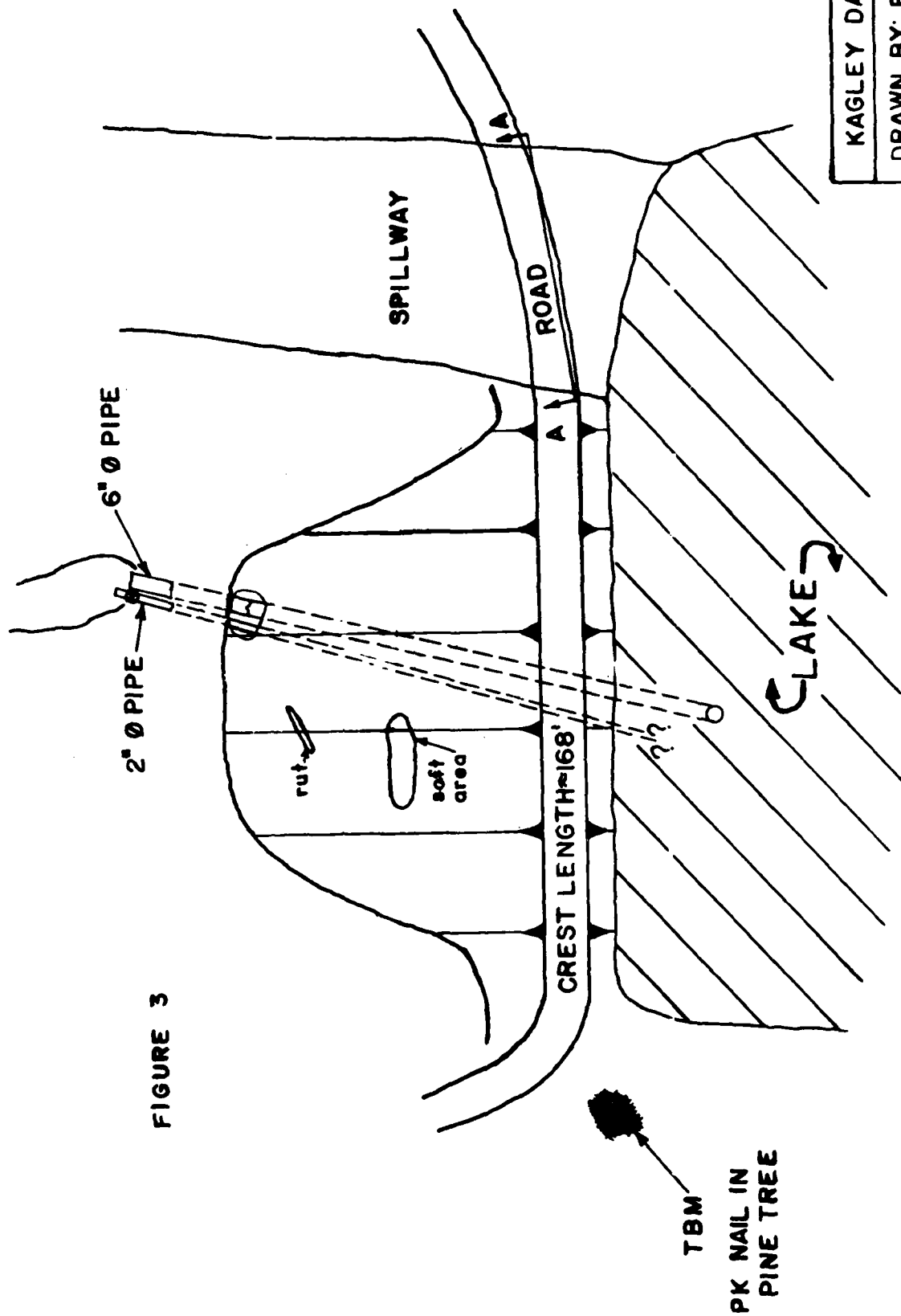


FIGURE 3

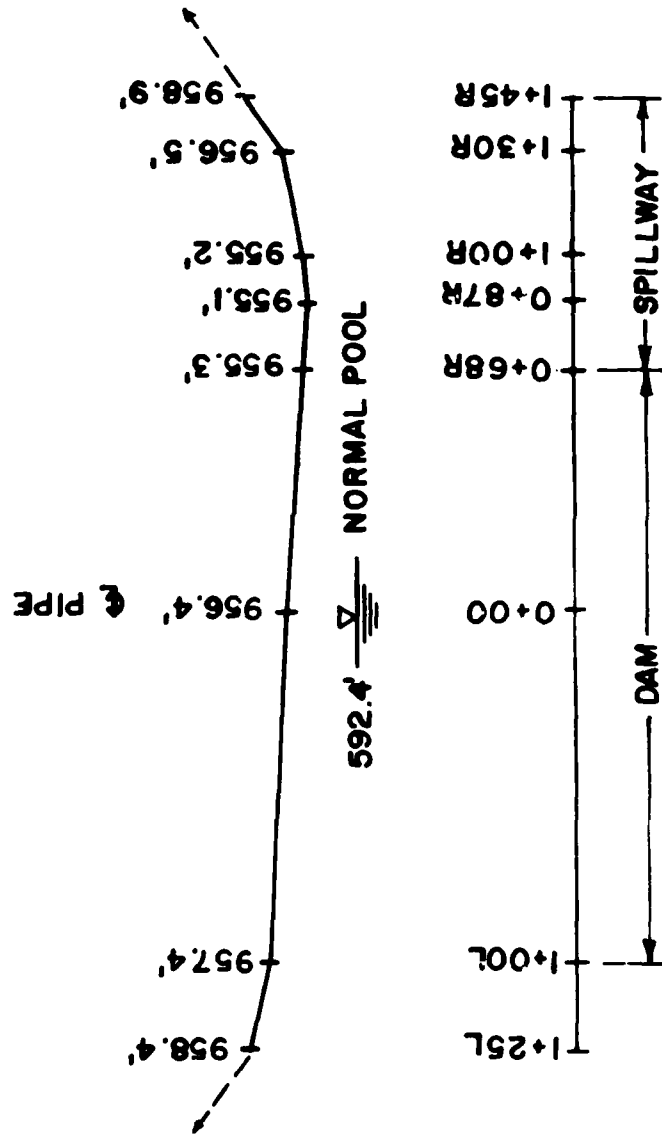
KAGLEY DAM

DRAWN BY: E.B.P.

DATE: 7/14/81

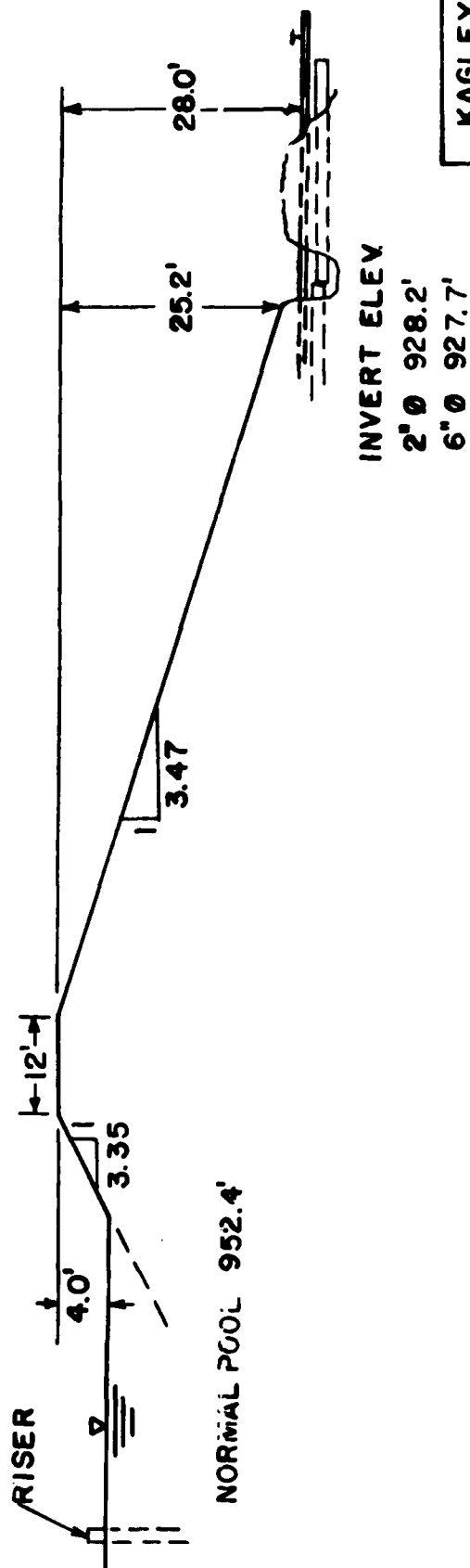
SCALE 1"=40'

DAM PROFILE
FIGURE 4



KAGLEY DAM
DRAWN BY: E.B.P.
DATE: 7/9/81
HOR. SCALE 1"=50'
VERT. SCALE 1"=10'

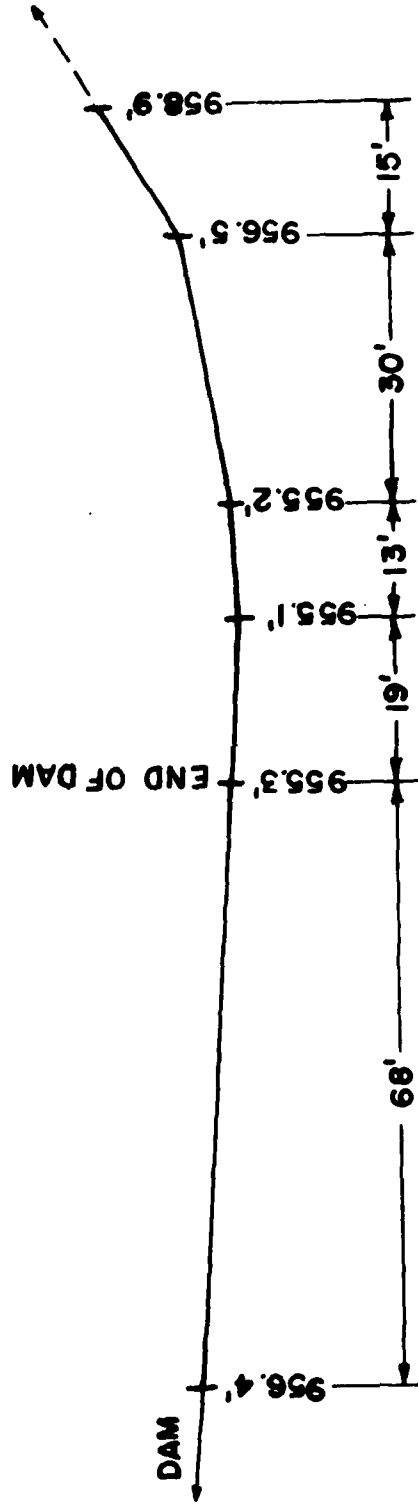
MAXIMUM SECTION
AT 0+00
FIGURE 5



KAGLEY DAM
DRAWN BY: E.B.
DATE: 7/15/81
SCALE: 1" = 20'

SPILLWAY CROSS-SECTION A-A

FIGURE 6



KAGLEY DAM

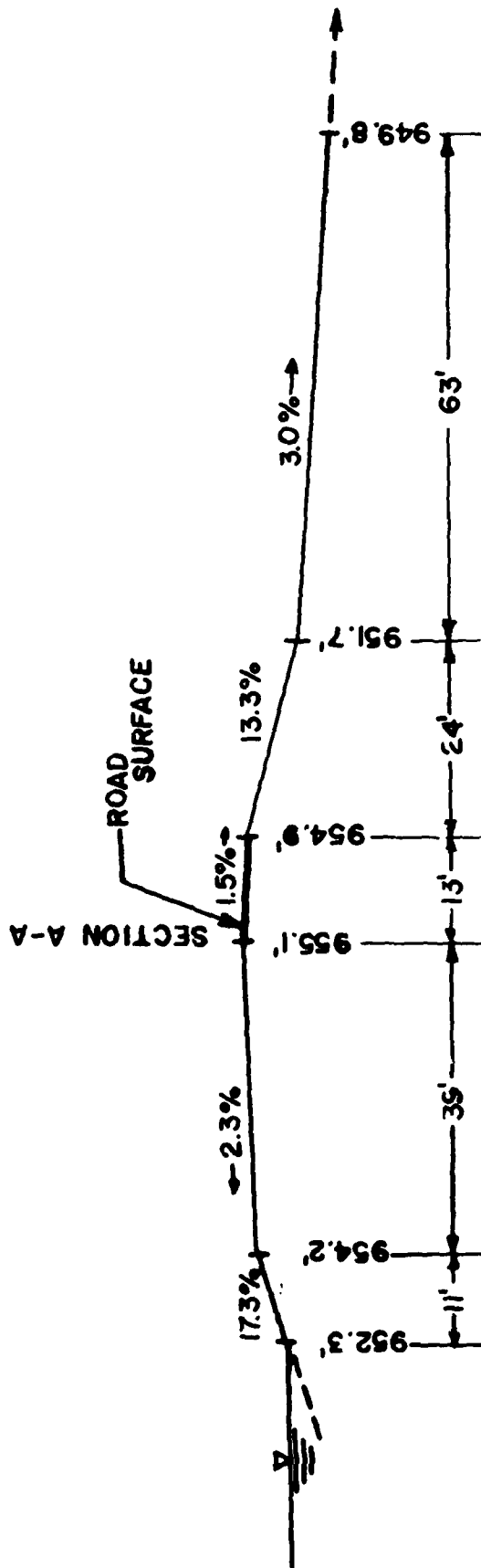
DRAWN BY: E.B.P.

DATE: 7/9/81

HOR. SCALE 1"=2'

VERT. SCALE 1"=2'

SPILLWAY PROFILE
FIGURE 7



KAGLEY DAM

DRAWN BY: E.B.P.

DATE: 7/9/81

HOR. SCALE 1"=10'

VERT. SCALE 1"=20'

APPENDIX C
PHOTOGRAPHIC RECORD

Kagley Dam
Photographic Record

- Photo No. 1 - View of reservoir from embankment crest.
Note service spillway riser to the right.
- Photo No. 2 - View of the upstream face and crest from
emergency spillway entrance channel.
- Photo No. 3 - View of downstream face. Note hole near toe
and house in floodplain.
- Photo No. 4 - View of downstream face showing spillway
exit channel along right abutment.
- Photo No. 5 - Toe area near service spillway outlet.
Note inspector by hole.
- Photo No. 6 - Service spillway outlet and water supply
pipe outlet.
- Photo No. 7 - Service spillway outlet and water supply
pipe outlet.
- Photo No. 8 - Water supply pipe outlet. Note crack in
valve.
- Photo No. 9 - Emergency spillway at right abutment.
- Photo No. 10 - View from the toe locating soft area near
inspector, erosion rut, and hole.
- Photo No. 11 - Soft area.
- Photo No. 12 - Erosion rut.
- Photo No. 13 - Erosion hole from break in spillway pipe.
- Photo No. 14 - Break in service spillway pipe. Note water
supply pipe location.



PHOTO NO.1



PHOTO NO.2



PHOTO NO.3



PHOTO NO.4



PHOTO NO.5



PHOTO NO.6



PHOTO NO.7

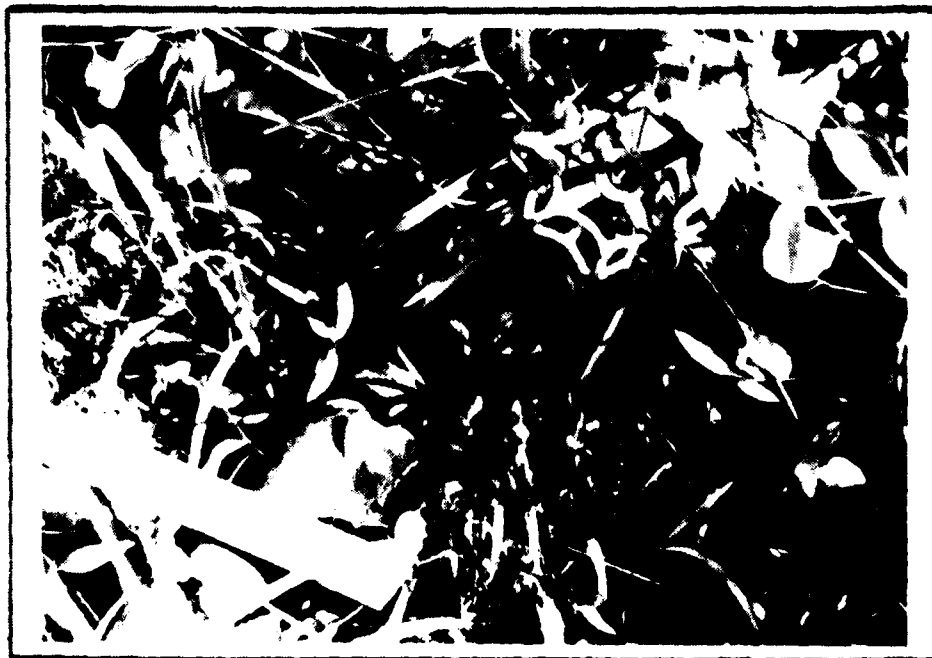


PHOTO NO.8



PHOTO NO.9



PHOTO NO.10



PHOTO NO .11



PHOTO NO .12

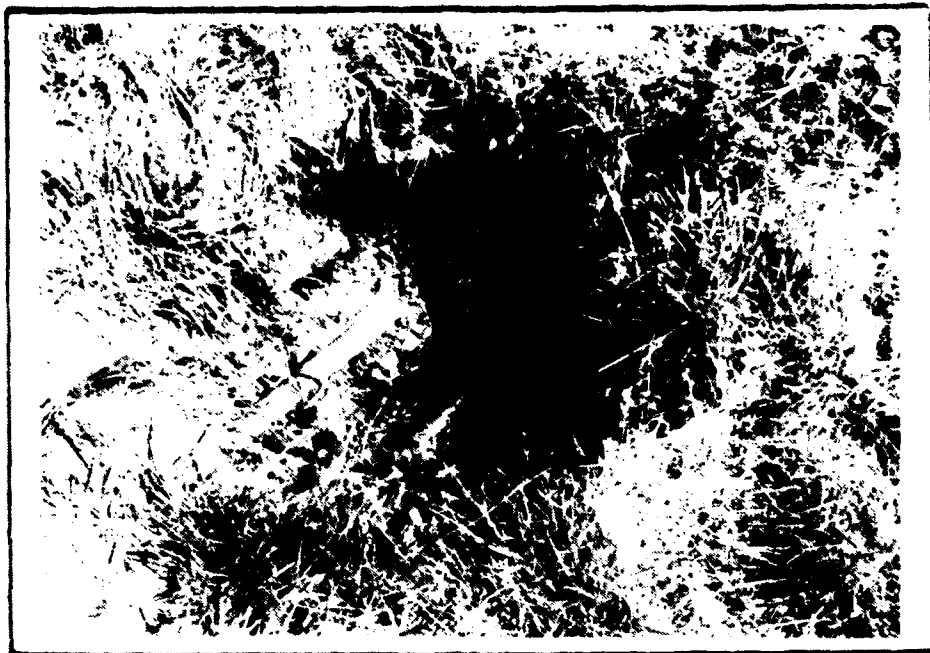


PHOTO NO .13



PHOTO NO .14

APPENDIX D
INSPECTION CHECKLIST

Name of Dam Kagley
County Blount Date of Inspection May 19, 1981
ID # - State 5-7008 Federal TN-908
Type of Dam Earth
Hazard Category-Federal High State 1
Weather Windy, partly cloudy Temperature 80°F
Pool at Time of Inspection 4.5' (distance from crest)
Tailwater at Time of Inspection 0 (distance from stream bed)
Design/As Built Drawings Available: Yes _____ No X
Location: _____
Copy Obtained: Yes _____ No X
Reviewed: Yes _____ No X
Construction History Available: Yes _____ No X
Location: _____
Copy Obtained: Yes _____ No X
Reviewed: Yes _____ No X
Other Records and Reports Available: Yes _____ No X
Location: _____
Copy Obtained: Yes _____ No X
Reviewed: Yes _____ No X
Prior Incidents or Failures: Yes _____ No X
Inspection Personnel and Affiliation
Ed O'Neill - TDWR
Troy Wedekind - TDWR
George Moore - TDWR

I. Embankment

A. Crest

Description (1st inspection) Clear, gravel road
with some asphalt with constant width and a general
decline in the crest elevation near the right end of
the dam.

1. Longitudinal Alignment Linear with smooth transition
at the abutments.

2. Longitudinal Surface Cracks None found

3. Transverse Surface Cracks None found

4. General Condition of Surface Good, adequate grass
cover.

5. Miscellaneous _____

B. Upstream Slope

1. Undesirable Growth or Debris None found

2. Sloughing, Subsidence, or Depressions None found

3. Slope Protection Grass

a. Condition of Riprap None found

b. Durability of Individual Stones None found

c. Adequacy of Slope Protection Against Waves
and Runoff Some minor sloughing at water surface
with benching.

d. Gradation of Slope Protection - Localized Areas
of Fine Material N/A

4. Surface Cracks None found

C. Downstream Slope

1. Undesirable Growth or Debris 3 pines @ 4" dia.

2. Sloughing, Subsidence, or Depressions; Abnormal
Bulges or Non-Uniformity About 1/3 way from left
abutment near toe, apprx. 10' long roughly 2'
wide rut
3. Surface Cracks on Face of Slope None found
4. Surface Cracks or Evidence of Heaving at
Embankment Toe None found
5. Wet or Saturated Areas or Other Evidence of Seepage
on Face of Slope; Evidence of "Piping" or "Boils"
Soft area w/ wetland vegetation 1/4 way from left
abutment roughly 10' above toe.
6. Drainage System None found
7. Fill Contact with Outlet Structure None found
8. Condition of Grass Slope Protection Good

D. Abutments

1. Erosion of Contact of Embankment with Abutment from Surface Water Runoff, Upstream or Downstream _____

None found

2. Springs or Indications of Seepage Along Contact of Embankment with the Abutments _____ None found

3. Springs or Indications of Seepage in Areas a Short Distance Downstream of Embankment - Abutment Tie-in

None found

4. Miscellaneous 4" drainage pipe, PVC U/S and cast

iron D/S; sediment at downstream end attributed to recent rain.

II. Area Downstream of Embankment, Including Channel

A. Localized Subsidence, Depressions, Sinkholes, Etc. _____

4' dia hole at the toe that is 3' deep. At the bottom

of the hole is the 6" steep principle spillway pipe apparently
broken & displaced @ a joint. See Section IIM

B. Evidence of "Piping", "Boils", or "Seepage" _____

Small seep to the left of the 6" pipe in the hole.

C. Unusual Presence of Lush Growth, such as Swamp

Grass, etc. None found

D. Unusual Muddy Water in Downstream Channel _____

Some sediment in channel near outlet of 6" pipe apparently
from erosion in hole.

E. Sloughing or Erosion _____

F. Surface Cracks or Evidence of Heaving Beyond

Embankment Toe None found

G. Stability of Channel Sideslopes Adequate, relatively _____

shallow with natural angle of repose.

H. Condition of Channel Slope Protection Vegetation and _____

tree growth.

I. Adequacy of Slope Protection Against Waves, Currents,
and Surface Runoff N/A

J. Miscellaneous

K. Condition of Relief Wells, Drains, and Other
Appurtenances None found

L. Unusual Increase or Decrease in Discharge from
Relief Wells N/A

M. A 2" steel pipe was found in hole area running at a slight
angle to the 6" pipe. apparently locating the inlet of the
pipe at a different location than the appurtenant structure
in the lake. The outlet is near the 6" pipe outlet and is
valved downstream. The valve is cracked. The pipe is
believed to be used as a possible irrigation source.

III. Instrumentation - None

A. Monumentation/Surveys _____

B. Observation Wells _____

C. Weirs _____

D. Piezometers _____

E. Other _____

IV. Spillways

A. Service Spillway (Service/Emergency Combination Yes ___ No X)

1. Intake Structure Condition Apparent inlet covered
with a portion of a well tank.
2. Outlet Structure Condition Fair, partially filled with
sediment. Outlet area is covered with weeds & briars.
No stilling pool or riprap but no sign of erosion either.
3. Pipe Condition Fair, metal pipe with only some rust.
A weld of the pipe has broken about 15' upstream.
from the outlet end and caused erosion of surrounding
embankment.
4. Evidence of Leakage or Piping None found
5. General Remarks Lake level is being kept below normal
pool by means of the 2" drain so that there will not
be flow through the service spillway which is
causing the erosion of embankment at the break in
pipe.

B. Emergency Spillway

1. General Condition Clear and well grassed.
2. Entrance Channel Good
3. Control Section Shallow parabolic shape with
asphalt cover.

3. Exit Channel Well grassed with moderate slope;
for roughly 150'; shallow left bank.
4. Vegetative/Woody Cover No undesirable cover.
5. Other Observations Flow will damage portion of
downstream face.

V. Emergency Drawdown Facilities (if part of service spillway)

so state) A 2" water supply pipe located beside the service spillway outlet (See IIA) could be used to draw the lake down. The valve is located on the downstream

end and it is cracked.

Are Facilities Operable: Yes X No

Were Facilities Operated During Inspection: Yes X No

Date Facilities Were Last Used _____

VI. Reservoir

A. Slopes Moderate

B. Sedimentation Slight

C. Turbidity Some, visibility up to 2.5 feet.

VII. Drainage Area

Description (for hydrologic analysis) Mainly woodland
with pasture on some of the ridgetops.

A. Changes in Land Use Little expected; may be some
increase conversion to pasture.

VIII. Downstream Area (Stream)

A. Condition (obstructions, debris, etc.) Grassed banks
with a fallen tree 100' downstream.

B. Slopes Moderate

C. Approximate No. Homes, Population, and Distance D/S
One home within 700' downstream.

D. Other Hazards Medium use county road (Mint Road) and
pastureland.

IX. Miscellaneous

Incidents/Failures None

Observed Geology of Area No outcrops found but geologic maps indicate the site is on the Chota Formation.

X. Conclusions

- 1) Dam appears stable. 2) Break in pipe is not a threat to the dam but the possibility of other breaks is a threat to the embankment safety. 3) Spillway capacity is inadequate to pass P100. 4) Dam is classified as "unsafe - nonemergency".

XI. Recommendations

Obtain qualified engineer to:

- 1) Recommend project modifications of spillway to safely pass the design storm.
2) Investigate and make recommendations on the safety of the service spillway outlet pipe.
3) Develop an appropriate warning system.

The owner should:

- 1) Remove all trees from embankment.
2) Establish regular program of inspection and maintenance.
3) Monitor the soft area for any changes.

Frederick A. Wackel
Regional Engineer

Chief Engineer

APPENDIX E
HYDRAULIC AND HYDROLOGIC DATA

APPENDIX E

HYDRAULIC AND HYDROLOGIC DATA

Being in the small size and high hazard categories, Kagley Dam is required, according to OCE guidelines, to pass a design storm that would occur between the half to full PMF. Based on the U. S. Weather Service's Technical Paper Number 40 (TP-40) the 6-hour probable maximum precipitation (PMP) and 100 year storm (P_{100}) for the Kagley Dam watershed is 28.85 inches and 5.0 inches respectively. The dimensionless unit hydrograph technique described in Chapter 21, Section 4 of the SCS National Engineering Handbook was used to compute a runoff hydrograph using both antecedent moisture conditions II and III to determine runoff. The half PMF was formed by taking half the flow values for the PMF. The flood hydrographs were routed through the reservoir by the equation: $I_1 + I_2 + \frac{2S_1}{\Delta t} - O_1 = \frac{2S_2}{\Delta t} + O_2$.

The peak inflow for the P_{100} is 149.1 cubic feet per second (cfs) resulting in an outflow, which overtops the dam, of 20.5 cfs. The maximum depth of overtop is 0.18 feet and the duration of overtop is 2.57 hours. The maximum depth of overtop for the $\frac{1}{2}$ PMF with AMC II is 1.8 feet with a duration of overtop of 5.66 hours.

Kabley Dam

Blount Co.

July 14, 1981 TAW

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Basin Characteristics:

drainage area 93.6 acres (0.153 sq mi)
 average watershed slope, γ 23.8%
 longest flow length, L 2200 ft

SCS Curve Number

soil	% D.A.	H.S.G.	% soil usage
Tellico	30	B	75% woods; 25% pasture
Christian	60	C	60% woods; 40% pasture
Dandridge	10	D	70% woods, 30% pasture

$$AMC II CN = 0.30 [0.75(60) + 0.25(69)] \\ + 0.60 [0.60(73) + 0.40(79)] \\ + 0.10 [0.70(79) + 0.30(84)]$$

$$= 18.63 + 45.24 + 8.05 = 71.97 \text{ say } \underline{72}$$

$$AMC III CN = 86$$

TIME OF CONCENTRATION

$$T_c = \frac{L^{0.6}}{s^{0.5}} \\ L = (S+1)^{0.7} \frac{0.8}{1000} Y^{0.5} \\ S = (1000/CN) - 10$$

$$\therefore T_c = 0.1 \text{ hr} \quad \text{AMC II}$$

$$0.09 \text{ hr} \quad \text{AMC III}$$

Hydrograph Formation from National Engr. Handbook (NEH) Section 4
 Chapter 21

See Figures 1 thru 4

Kagley Dam

Blount Co.

July 14, 1981 TAW

7/6

Spillway Flow see Figure

Service Spillway

Riser

assume 6' dia. pipe w/ no flow restriction from cover

$$Q = C_w L H^{3/2} \quad (\text{weir flow for } 0 \leq H < R)$$

H is depth of flow; R is radius of pipe)

$$Q = C_o A \sqrt{2g} H^{3/2} \quad (\text{orifice flow for } H \geq R)$$

$$C_w = 3.0 \quad L = 2\pi R$$

$$C_o = 0.75 \quad A = \pi R^2$$

From "Design of Small Dams"

Outlet Pipe

assume inlet control and inlet invert @ 927.7

$$Q = C_o A \sqrt{2gh}$$

$$h = (\text{W.S. elev.} - 927.7)$$

$$A = \pi R^2$$

$$C_o = 0.6$$

Emergency Spillway

assume parabolic shape @ critical flow

$$Q = 2.005 T H_m^{3/2}$$

From Eq. 8-53 Brater & King "Handbook of Hydraulics"

 T = top width in feet from Figure 6

$$H_m = (\text{W.S. elev.} - 955.1)$$

Overtop Flow

assume parabolic channel from STA 0+00 to right abutment as above
and half of a trapezoidal channel from STA 0+00 to left abutment
with measurement from Figure 4

$$Q = 2.005 T H_m^{3/2} + \frac{1}{2} (C B h^{3/2}) \quad \text{From Eq. 8-53 & 8-69 Brater & King "Handbook of Hydraulics"}$$

 T = top width in feet from Figure 6

$$H_m = (\text{W.S. elev.} - 955.1)$$

$$C \approx 3.3 \text{ to } 3.6$$

$$B = 2 \times 100$$

$$h = (\text{W.S. elev.} - 956.4)$$

From table 9-7 Brater & King "Handbook of Hydraulics"

KAGLEY DAM

BLOUNT Co

July 23, 1981

2/6

FLOOD ROUTING CURVE (See Figure 5)

<u>ELEV</u>	<u>STORAGE (ac ft)</u>	<u>OUTFLOW (c.f.s.)</u>	<u>$\frac{2S}{\Delta t} + O$ (15 min c.f.s.)</u>
952.4	0.0	0.0	0
953.0	2.8	0.9	270
953.4	4.6	1.2	452
954.0	7.5	1.5	727
954.4	9.4	1.7	912
955.0	12.3	1.9	1192
955.4	14.2	15.2	1394
956.0	17.2	146.0	1810
956.4	19.1	320.4	2176
957.0	22.1	735.3	2882
957.4	24.2	1162.6	3504
958.0	27.2	1858.2	4296
958.4	29.3	2517.9	5355

KABLEY DAM

BLOUNT Co.

July 23, 1981 TALW

7/6

Sample calculations for P_{100} AMC II event

$$D.A. = 93.6 \text{ acres}$$

AMC II C.N. 72

$$P_{100} = 5.0 \text{ inches}$$

$$Q_{100} = 2.2 \text{ inches}$$

Hydrograph Family Number 3

$$Y = 23.8\%$$

$$L = 2200'$$

$$T_c = 0.1 \text{ hrs}$$

$$Rev T_o/T_p = 75$$

$$Q_{3P} = 2236 \text{ cfs}$$

$$Rev T_p = 0.07 \text{ hrs}$$

$$P_{100} \text{ peak flow} = 149.1 \text{ cfs @ } 0.9 \text{ hrs}$$

portion of P_{100} Hydrograph

n	$t \text{ (hrs)}$	$Q \text{ (cfs)}$
0	0.00	0.0
1	0.23	2.0
2	0.45	12.8
3	0.68	64.6
4	0.9	149.1 peak
5	1.13	99.5
6	1.36	70.9
7	1.58	57.5
8	1.81	49.0
9	2.04	43.6
10	2.26	39.4
11	2.49	35.8
12	2.71	32.9
13	2.94	30.4
14	3.17	28.4
⋮	⋮	⋮

Hydrograph volume check

$$\text{runoff volume} = 2.2 \frac{\text{in}}{\text{hr}} \times 93.6 \text{ ac} \times 43560 \frac{\text{sq ft}}{\text{ac}}$$

$$= 17.16 \text{ ac ft}$$

$$\text{hydrograph volume} = \frac{20 \times 446}{43560} \times 160$$

$$= 16.81 \text{ ac ft}$$

$$\text{error} = 1.6\%$$

∴ hydrograph volume ≈ runoff volume

KAGLEY DAM

BLOUNT Co.

Aug 2, 1981 TAW

5/6

P₁₀₀ FLOOD AMC II ROUTING

n	t (hrs)	I (cfs)	$\frac{2}{3}I - O$ (cfs)	$\frac{2}{3}I + O$ (cfs)	O (cfs)
0	0.00	0.0	0.0	0.0	0.0
1	0.25	3	2.9	3.0	0.05
2	0.5	17	22.7	22.9	0.1
3	0.75	89	128.1	128.7	0.3
4	1.0	149	364.3	366.1	0.5
5	1.25	80.5	591.8	593.8	1.0
6	1.5	61	731.1	733.3	1.1
7	1.75	51	842.3	843.1	1.4
8	2.0	44.5	932.6	935.8	1.6
9	2.25	40	1013.5	1017.1	1.8
10	2.5	36	1085.7	1089.5	1.9
11	2.75	32.5	1150.2	1154.2	2.0
12	3.0	30	1208.5	1212.7	2.1
13	3.25	28	1260.5	1266.5	3.0
14	3.5	26	1301.5	1314.5	6.5
15	$\begin{matrix} \uparrow 3.61 \\ \text{Overtop} \end{matrix}$ 3.75	25	1331.5	1352.5	10.5 $\begin{matrix} \text{Overtop} \\ 8.2 \end{matrix}$
16	4.0	24	1353.1	1380.5	13.7
17	4.25	23.5	1366.6	1400.6	17.0
18	4.5	23	1377.1	1413.1	18.0
19	4.75	22.6	1383.7	1422.7	19.5
20	5.0	22	1387.3	1428.3	20.5 $\begin{matrix} \text{Overtop} \\ 155.58 \end{matrix}$
21	5.25	17	1386.3	1426.3	20.5
22	5.5	0.2	1371.5	1403.5	16.0
23	5.75	0.0	1346.7	1371.7	12.5
24	$\begin{matrix} \uparrow 6.18 \\ \text{Overtop} \end{matrix}$ 6.0	}	1326.7	1346.7	10.0 $\begin{matrix} \text{Overtop} \\ 8.2 \end{matrix}$
25	6.25		1311.7	1326.7	7.5
...

Conclusion: spillway capacity inadequate; embankment overtopped to a maximum depth of 0.18' and an overtop duration of 2.57 hrs.

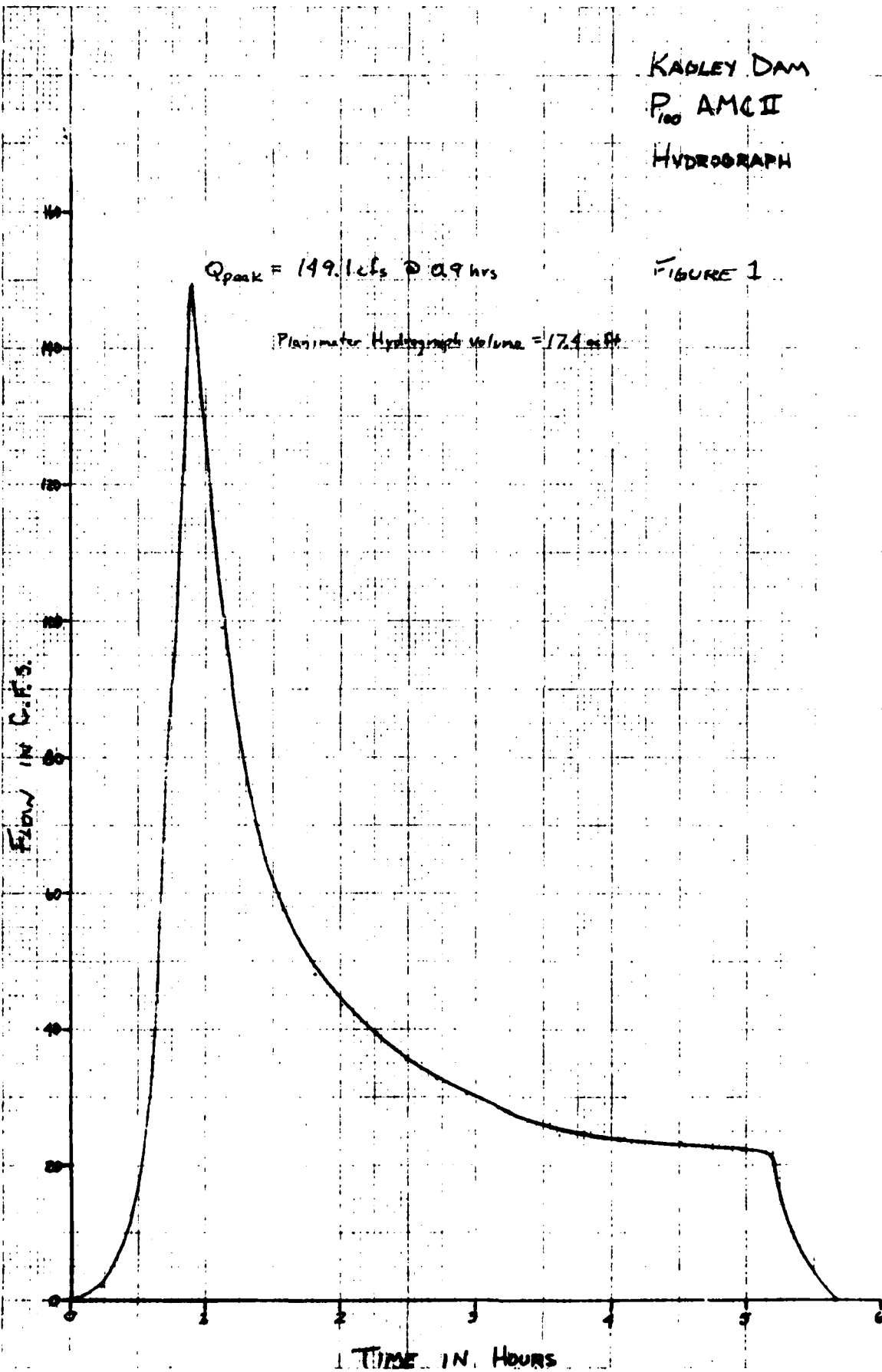
KAGLEY DAM
SUMMARY OF ROUTINGS

EVENT	ANTECEDENT MOISTURE CONDITION	
	II	III
6 hr. PMF	Overtopped at elev. 957.5 for a duration of 6.03 hrs. at a max. depth of 2.2'	Overtopped (Not routed)
6 hr. $\frac{1}{2}$ PMF	Overtopped at elev. 957.1 for a duration of 5.66 hrs. at a max. depth of 1.8'	Overtopped (Not routed)
6 hr. 100 - YEAR	Overtopped at elev. 955.48 for a duration of 2.57 hrs. at a max. depth of 0.18'	Overtopped at elev. 955.7 for a duration of 4.53 hrs. at a max. depth of 0.4'



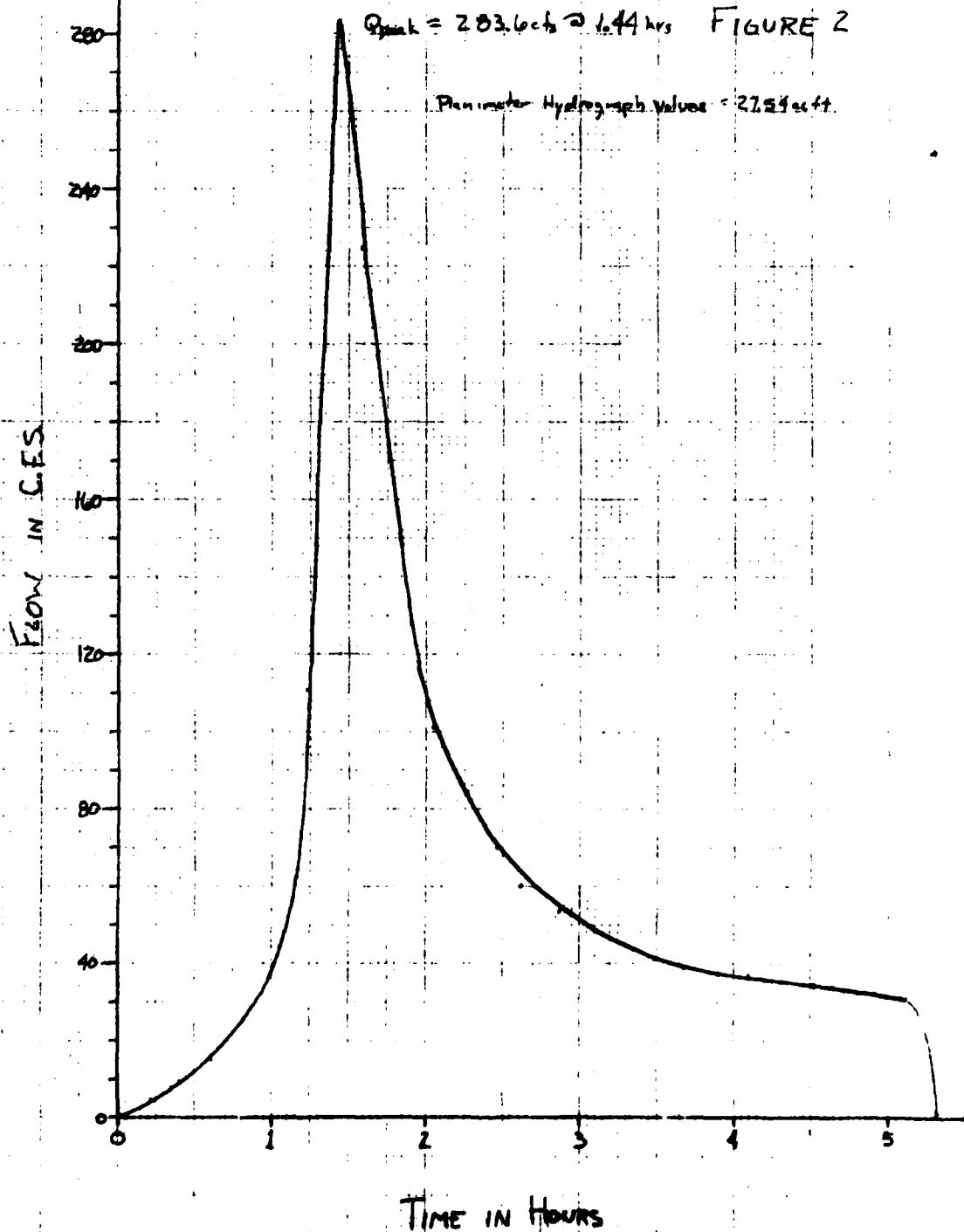
KADLEY DAM
P₁₀₀ AMC II
HYDROGRAPH

FIGURE 1





KAGLEY DAM
P₁₀₀ AMCIII
HYDROGRAPH



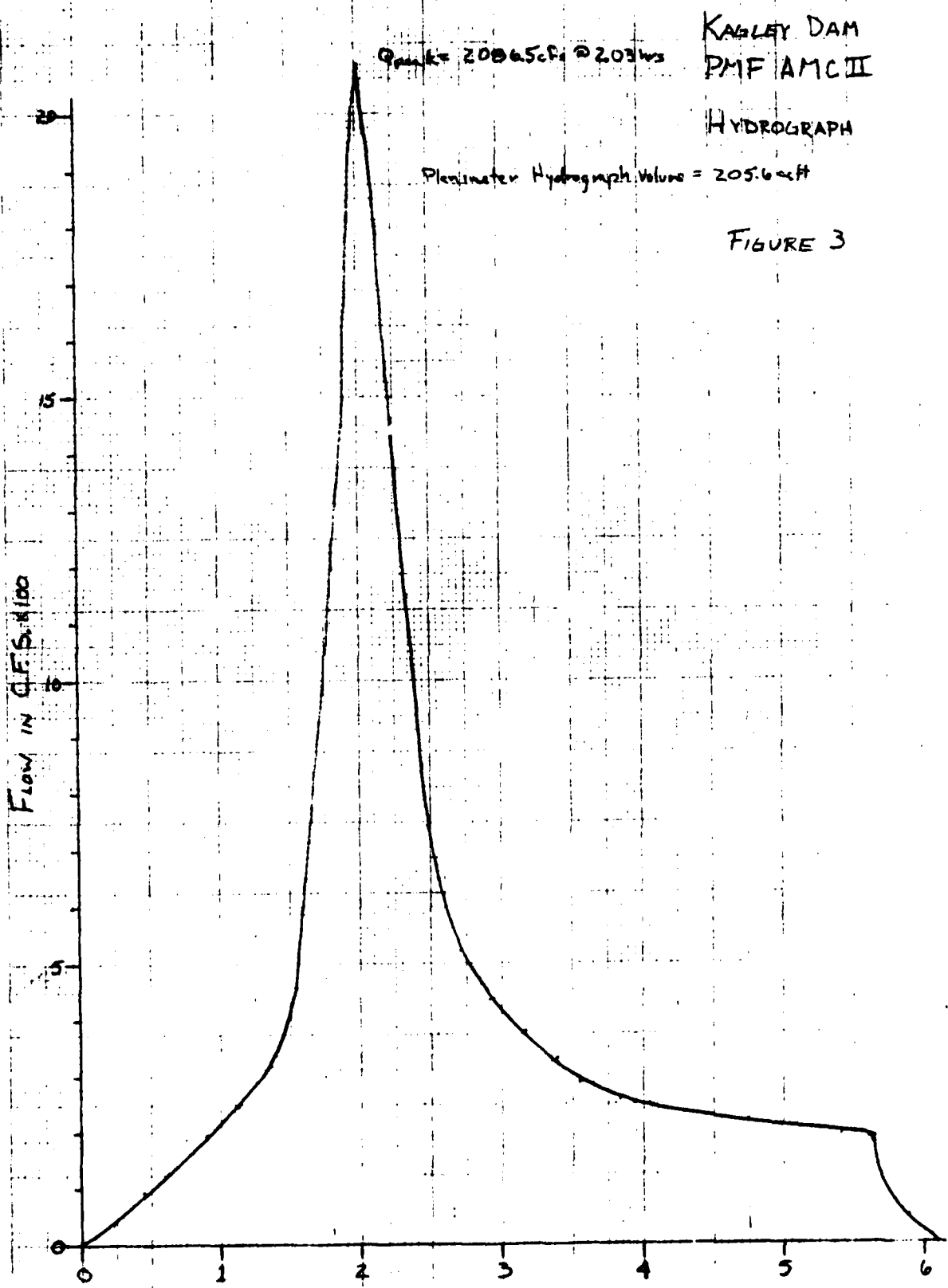
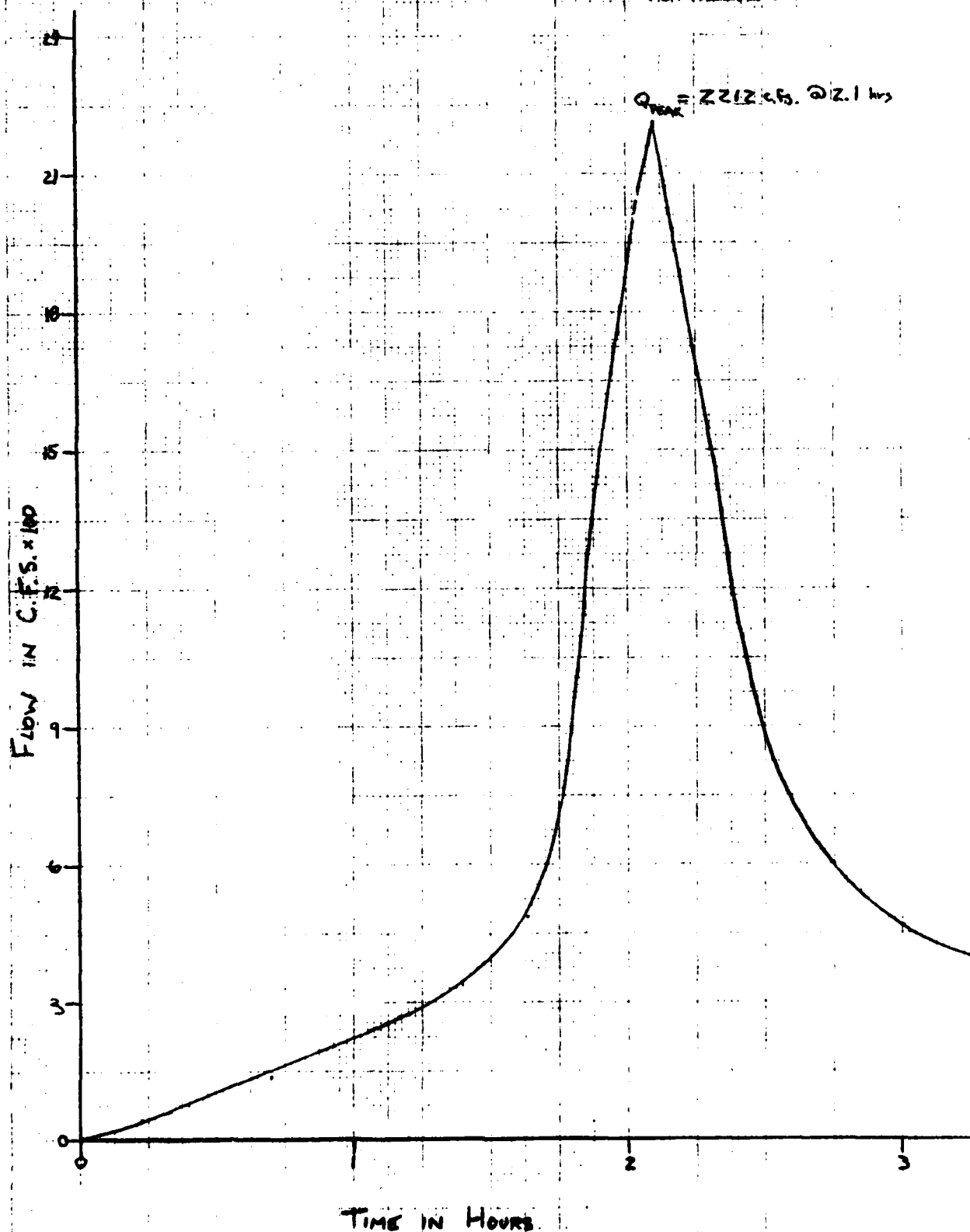


FIGURE 3

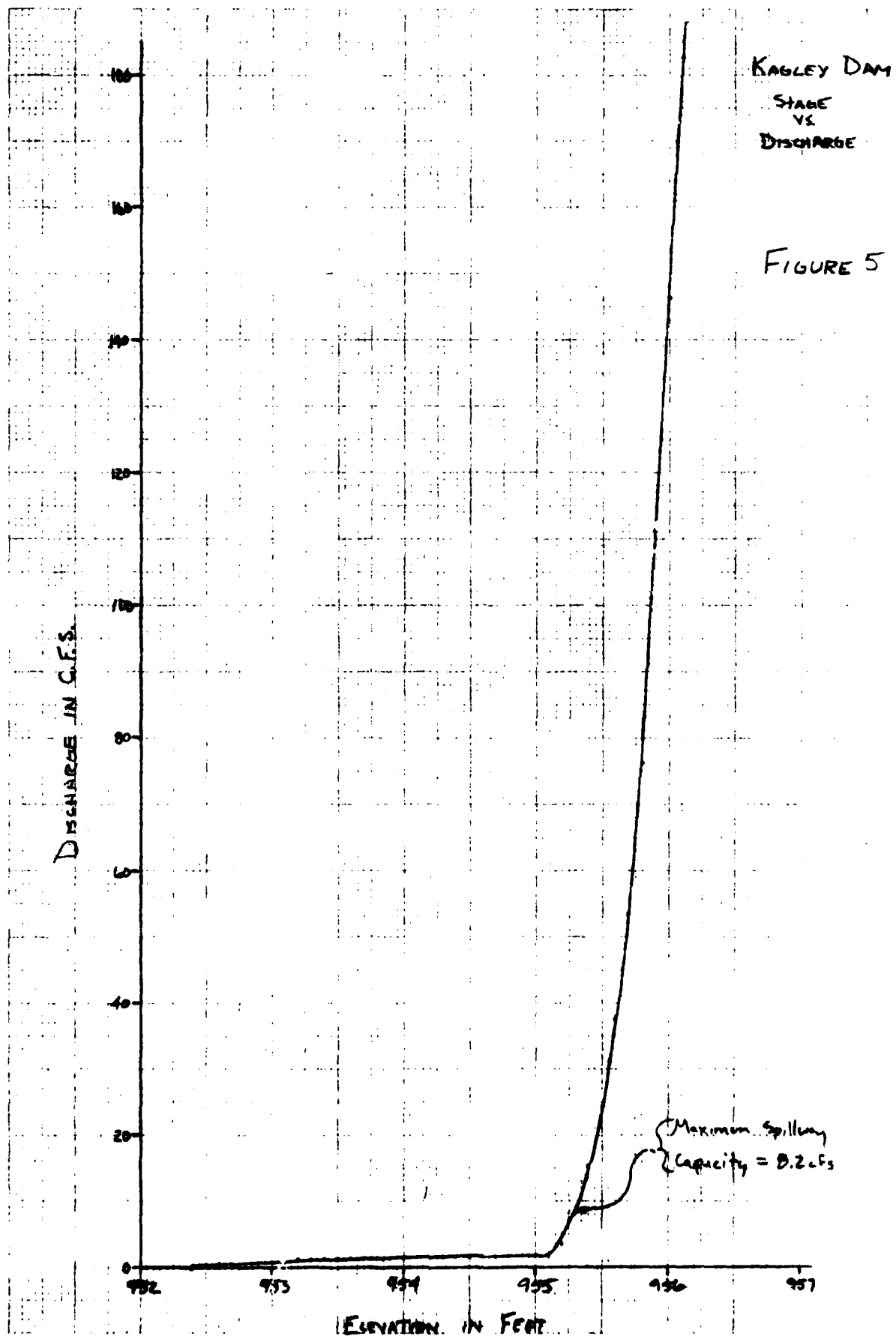


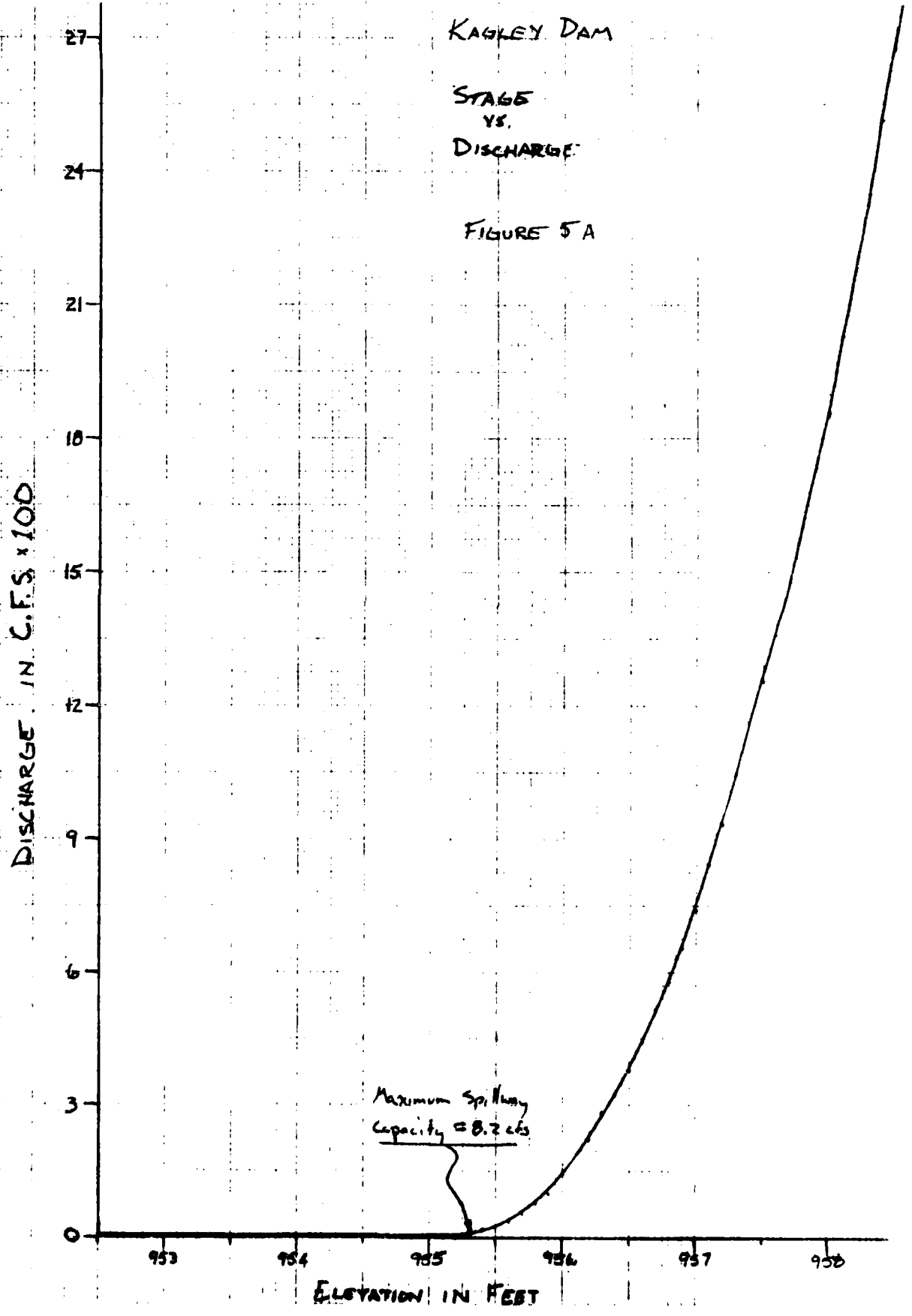
FIGURE 4

KAGLEY DAM
PMF AMC III
HYDROGRAPH



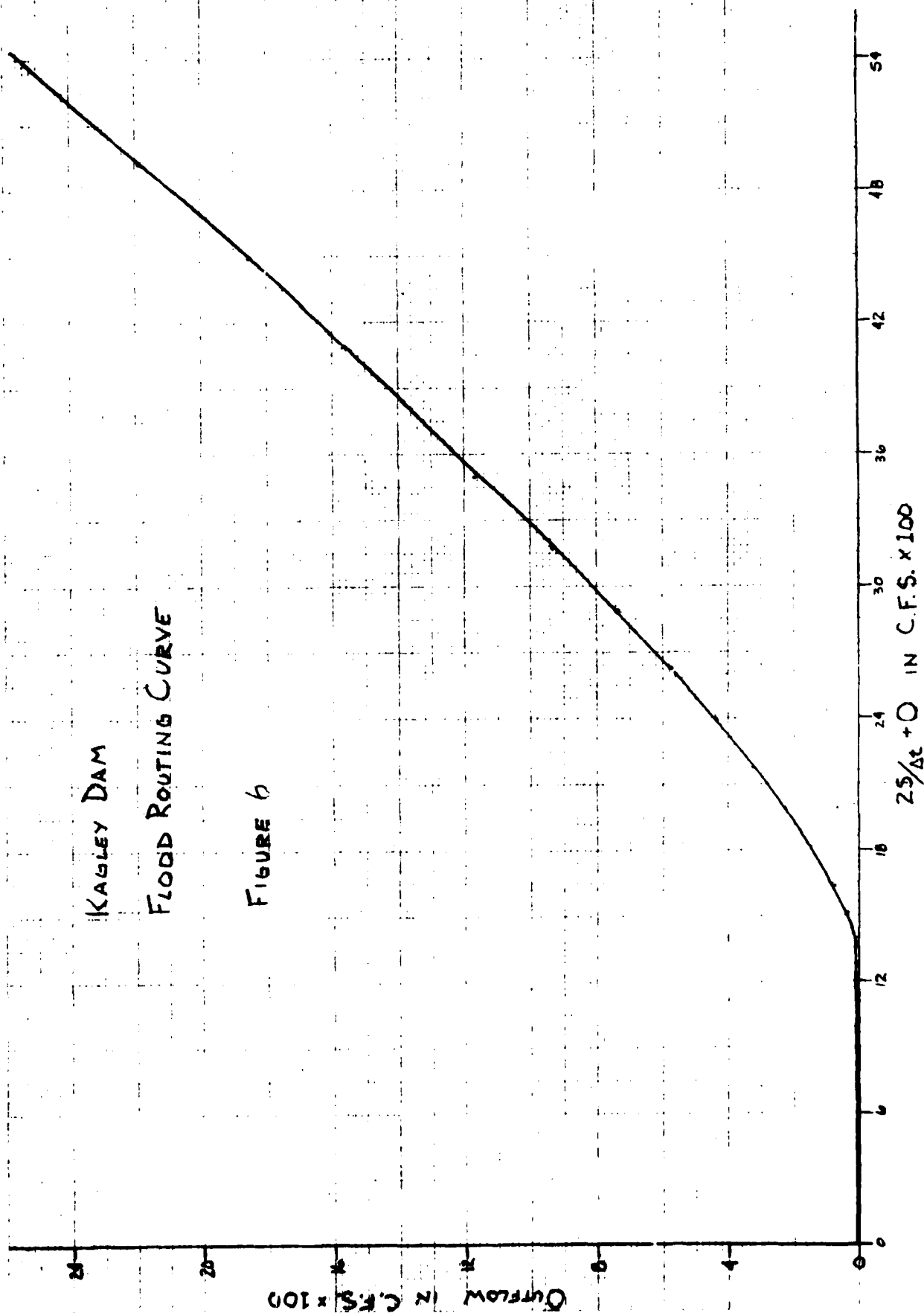
$Q_{\text{PEAK}} = 22.12 \text{ cfs. @ } 2.1 \text{ hrs}$





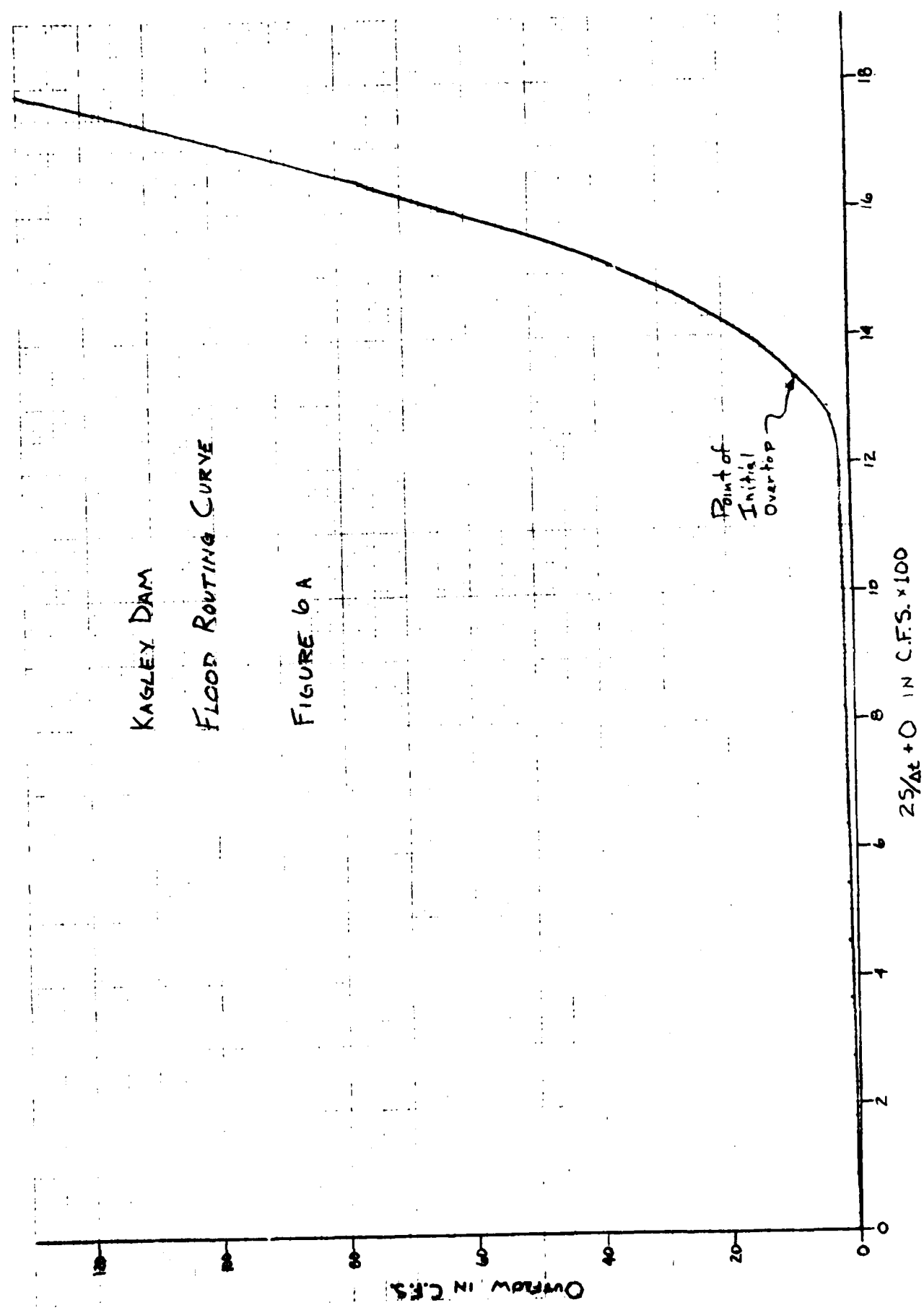
KAGLEY DAM FLOOD ROUTING CURVE

FIGURE 6



KAGLEY DAM FLOOD ROUTING CURVE

FIGURE 6A



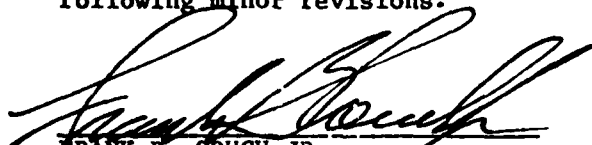
APPENDIX F
CORRESPONDENCE


NON-FEDERAL DAM INSPECTION REVIEW BOARD
PO BOX 1070
NASHVILLE, TENNESSEE 37202

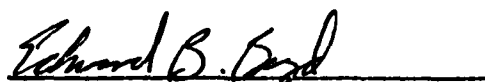
ORNED-G

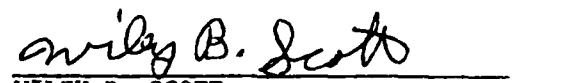
Commander, Nashville District
US Army, Corps of Engineers
PO Box 1070
Nashville, TN 37202


1. The Interagency Review Board, appointed by the Commander on 19 June 1981, presents the following recommendations after meeting on 3 September 1981, to consider the Phase I investigation report on Kagley Dam inspected by the Tennessee Department of Conservation.
2. A qualified engineer should investigate and make recommendations concerning the broken 2-inch pipe. The valve on this pipe should be moved to the upstream side of the dam.
3. The owner should periodically check the soft area on the embankment and consult a qualified engineer should any changes occur.
4. The Board is in agreement with other report conclusions and recommendations following minor revisions.



FRANK B. COUCH JR.
Chief, Geotechnical Branch
Chairman


EDMOND B. O'NEILL
Alternate, Division of Water
Resources
State of Tennessee


EDWARD B. BOYD
Hydrologic Technician
Alternate, US Geological Survey


WILEY B. SCOTT
Assistant Design Engineer
Alternate, Soil Conservation Service


THOMAS ALLEN
Hydraulic Engineer
Alternate, Hydrology and Hydraulics
Branch


L. E. LOCKETT
Structural Engineer
Alternate, Design Branch



DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT, CORPS OF ENGINEERS
P. O. BOX 1070
NASHVILLE, TENNESSEE 37202

16 SEP 1981

IN REPLY REFER TO

ORND-G

Honorable Lamar Alexander
Governor of Tennessee
Nashville, TN 37219

Dear Governor Alexander:

Please be informed of the results of an inspection, under authority of Public Law 92-367, conducted on Kagley Dam in Blount County, Tennessee. An inspection team, composed of personnel from your Division of Water Resources, observed conditions which indicate a high potential for failure of the embankment dam due to seriously inadequate spillway capacity and other serious deficiencies.

Kagley Dam is classified as a high hazard potential, small size dam and, as such, should be able to regulate at least a one-half probable maximum flood (1/2 PMF) to conform to inspection program guidelines. A hydraulic analysis of the project's spillway showed the dam would be substantially overtopped by a one-half probable maximum flood. A visual inspection also indicated that the spillway outlet pipe may be defective.

Based on the results of the visual inspection and due to the seriously inadequate spillway capacity, the dam is considered unsafe. While I do not view this as an emergency at this time, I recommend you initiate prompt action by the State to cause the owner to correct the deficiencies as soon as practical to minimize the risk to the residents located downstream.

A report of the technical investigation will be furnished your office upon completion.

Sincerely,

LEE W. TUCKER
Colonel, Corps of Engineers
Commander

CF:
Mr. Robert A. Hunt, Director
Division of Water Resources
4721 Trousdale Drive
Nashville, TN 37220

**DAT
FILM**